



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

March 12, 2014

Catherine Jerrard
Program Manager/BEC
AFCEC/CZRB-Griffiss
706 Brooks Road
Rome, New York 13441

Re: Draft Final Remedial Design/Remedial Action Work Plan for the ST-12 Fuels Spill Sites, Former Williams Air Force Base, Mesa, AZ, January 29, 2014

Dear Ms. Jerrard

EPA has reviewed the Draft Final Remedial Design and Remedial Action Work Plan (RAWP) for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona, dated January 29, 2014. Our comments outlined below are particularly concerned with the decision criteria for transitioning from Steam Enhanced Extraction (SEE) to Enhanced Bioremediation (EBR) and on the monitoring data collection to support the transition criteria.

General Comments

1. EPA considers the SEE portion of the remedy to be the most critical phase of the project and more effective at addressing the contamination than the EBR phase of the project. SEE is the primary component of the remedy, and EBR is being employed as a finishing step to address residual contamination. The effectiveness of EBR will be diminished if significant quantities of free product remain in the subsurface after SEE. Thus, determining when to terminate the SEE operation and transition to EBR is a critical decision point affecting the ultimate success of the remedy. In a SEE project, well construction and infrastructure represent the most significant cost investment; energy input is a comparatively minor contribution to the overall cost. Given the intended reuse of extracted jet fuel to operate the SEE system components, EPA believes the cost of energy input should not be a significant factor in determining when to terminate thermal remediation.

2. Section 4.2.4: 'Multiple lines of evidence' are commonly used to support the decision on when to terminate thermal remediation, and commonly includes ensuring that the target temperatures are obtained throughout the treatment area, determining that the recovery rate of contaminants is diminishing to a small, relatively constant rate, and determining that groundwater concentrations verify that nonaqueous phase liquids do not remain in the treatment area. This project will transition from SEE to EBR with the objective of reaching cleanup goals for benzene in 20 years. Therefore, dissolved benzene concentrations in the Target Treatment Zone (TTZ) are of particular interest in evaluating the successful completion of remediation. In order to meet the overall remedial objectives, the benzene concentrations remaining in the TTZ should be the most important criteria for evaluating the progress of the SEE remediation and determining when to transition to EBR, as this is directly tied to the time frame for meeting the remedial

goals.

3. It is EPA's understanding that this RAWP is also the sampling and analysis plan for performance and compliance monitoring, while process monitoring will be detailed in the SEE Operation, Maintenance, and Monitoring (OM&M) manual (Section 5.6.3, page 5-5). In light of this fact, the RAWP must clearly state what compliance and performance monitoring will be done, where samples will be obtained, what type of samples they will be, and minimum frequency at which each of these types of samples will be obtained. This should include both screening sampling, such as data obtained with an instrument such as a Flame Ionization Detector (FID), as well as analytical samples. The document itself must also be consistent with the Quality Assurance Project Plan (QAPP) worksheets in Appendix H. The specific comments below list several places where information is lacking, discrepancies occur, or the information provided requires clarification. Additional information and/or clarification may be required in other sections to provide a comprehensive, consistent, and understandable sampling and analysis plan for the performance and compliance monitoring. It would be very helpful to have all of the performance and compliance sampling detailed in one location.

Specific Comments:

1. Section 4.2.2, page 4-5: Lines 1258 to 1260 state, "Monitoring of temperature within and at the perimeter of SEE, groundwater elevations and LNAPL accumulation outside the TTZ, and perimeter groundwater benzene concentrations will be used to demonstrate containment." Please clarify how temperature monitoring will be used to demonstrate containment, and how the temperature measurements will be made. Generally for a steam injection remediation using an outside-in approach to steam injection, temperature measurements at the perimeter of the treatment area cannot be used to demonstrate containment, as the steam will flow radially in all directions from the injection wells, heating the perimeter area outside of the TTZ as well as the TTZ. However, if some areas of the perimeter will be employing extraction only, temperature measurements may be useful to demonstrate containment. This comment also applies to Section 5.8, starting at line 1860, where the same statement is made.

2. Table 4-2, SEE to EBR Transition Criteria: The third row of this table states that Mass Removal Rates of less than 10 percent of the peak removal rate is one of the target criteria for transition from SEE to EBR. From experience at other thermal remediation sites, the peak extraction rates are high enough that significant quantities of contaminant mass are still being recovered when the extraction rate decreases to 10 percent of the peak rate. This may particularly be true at this site, where a very large quantity of contaminant mass is present in the subsurface. Generally, rather than stating a target reduction in mass recovery, the criteria used is 'diminishing returns' in mass recovery, or a low mass recovery rate that does not reduce further with time.

3. Table 4-2 Mass Removal criteria, cont. As is pointed out in the Description of this criterion, contaminant mass from around the perimeter of the TTZ may contribute a continuing source of mass for removal by the SEE system, even after recovery from the interior of the TTZ has decreased to a low rate. Performance monitoring should include being able to determine the amount of contaminant mass coming from the interior of the TTZ separate from the amount being recovered from the perimeter. If the removal rate from the perimeter is as much as 10 percent of the peak mass recovery during SEE, then significant mass must exist outside of the TTZ, and consideration should be given to expanding the SEE to encompass this area. Without treating that area with SEE, it would be questionable that the cleanup criteria can be met in the desired timeframe.

3. Table 4-2 Steam Injection Criteria: The last row of this table states that the cumulative mass of steam injected is a criterion to be evaluated to determine when to transition from SEE to EBR. The proposed estimate of steam injection is based upon 1.6 pore volume flushing, which seems a low projection based on our understanding of cumulative steam injection mass at other sites. While that this criterion appears to be based on modeling performed by TerraTherm, EPA notes that it is extremely difficult to model recovery rate and time in terms of energy input. EPA has typically seen this analysis presented for cost estimating purposes as a way to balance cost against performance of an alternative at the Feasibility Study stage. The estimate may be useful as a minimum operational measurement to signal when the project is approaching completion, however, EPA prefers that this criterion not be used to evaluate attainment of remedial goals for SEE.

5. Table 5-1, Baseline Groundwater Sampling Summary: The table appears to show two rounds of sampling, the first to measure water levels and product accumulation in “developed” wells, the second round to obtain samples for Volatile Organic Compounds (VOCs) and Total Petroleum Hydrocarbons (TPH) from “redeveloped” wells. Please clarify what baseline groundwater sampling is to be performed; a single event or two events, to eliminate confusion.

6. Table 5-2 SEE Operations Sampling and Analysis, subsurface temperature : The first row of this table states permanent Temperature Monitoring Points (TMPs) will be installed at all Lower Saturated Zone (LSZ) Steam Injection Wells (SIWs), and mobile temperature arrays will be used to monitor temperatures in the remaining Multiphase Extraction Wells (MPEs) and SIW. While temperature monitoring at the steam injection wells will show which intervals are taking steam and ensure that the bottom of the screen interval is receiving steam, it is also important to determine when and at what depths the steam front breaks through at the MPE wells. What is the reason for having the thermocouples permanently at the SIW and only temporarily at the MPEs? This comment also applies to TerraTherm’s Design for SEE Treatment (Appendix D), Section 2.2, page 4, last bullet.

7. Table 5-2 SEE Operations Sampling and Analysis, pressure cycling: The second row of this table states that vapors produced during pressure cycling will be primarily monitored with hand held devices. Since hand held devices will not indicate how much benzene is produced during pressure cycling, please consider adding analytical samples during each pressure cycle, specifically to aid in determining the amount of benzene still being recovered.

8. Table 5-2 Mass Removal: The third row of this table indicates that sampling will be performed to determine the mass removal rate. How will the mass extracted from vapors at the vapor collection manifold be determined? How frequently will these measurements be made? How will mass in the air stripper off gas be measured, and how frequently will it be measured? What will the liquid samples be analyzed for – VOCs? TPH? How frequently will the liquid samples be analyzed? How frequently will the LNAPL level be measured in the storage tank?

Due to the rapidly changing concentrations in the vapor phase throughout thermal remediation, EPA recommends analytical samples be collected from the vapor collection manifold weekly at a minimum, with FID samples collected daily. Extracted water concentrations will not be as variable, so monthly samples of the extracted water are likely adequate. Since LNAPL will be consumed in the boilers, the amounts entering and leaving the storage tank will need to be measured at the same frequency in order to know the total amount of LNAPL recovered. Recovered reuse of LAPL as fuel for the SEE system should be also quantified for the carbon footprint assessment.

9. Table 5-2 Benzene Concentrations: The fourth row of this table states that samples of extracted water will be used to evaluate benzene concentrations during SEE operations. Please specify the laboratory method to be used and the frequency with which these samples will be collected or indicate where these

details are specified elsewhere in the report.

10. Section 5.6.3, page 5-8 line 1739: The text states that groundwater samples will be collected at the inlet to the water treatment system to track the progress of the remediation. How frequently will these samples be obtained?

11. Table 5-3 Operation Performance Summary: Will laboratory samples of the effluent from the stack be analyzed, or will only FID monitoring be used?

12. Table 5-4 Operational Perimeter Groundwater Monitoring Summary: Please show the locations of the perimeter groundwater monitoring wells specified in the table on a figure that is readable (Figure 1-3 is not readable).

13. Table 5-5 Proposed Well Replacement for Annual Groundwater Monitoring: Please show the locations of the wells to be abandoned and the replacement wells on a figure that is readable.

14. Appendix H, Worksheet No. 11, page 2: The eighth bullet on this page lists, “Has mass removal decreased, following pressure cycling, to rates less than or equal to the peak mass removal rate?” as a decision criteria for the work plan. EPA proposes an alternative decision statement, ‘Has mass removal from the TTZ decreased, following pressure cycling, to an insignificant, relatively constant rate?’

15. Appendix H, Worksheet No. 18, Table 18.4: The title of this table is ‘Process Sampling During Operation to Support Remediation Decisions’. However, it is not clear how the proposed sampling included in this table will support remedial decisions, or what the remediation decisions are. If remediation decisions are meant to be the transition from SEE to EBR, then the performance monitoring listed in Table 5-2 (subsurface temperatures, vapor concentrations during pressure cycling (please see comment 7), recovered LNAPL as determined by flow meters and levels in LNAPL storage tanks, mass in extracted vapors as determined at the vapor collection manifold, mass in extracted water as measured in air stripper off gas and liquid laboratory samples, and benzene concentrations in extracted groundwater), should all be included in Table 18.4. Sampling of the Thermal Accelerator Influent and Effluent (rows 1, 2, and 3) and GAC influent, midfluent, and effluent (rows 4, 5 and 6) appear to be compliance sampling (see page 5-7), and the sampling listed for the LNAPL Storage (row 7) appears to be process sampling, to determine the suitability of the LNAPL as a fuel source for the boilers. It also would be very helpful if performance sampling, compliance sampling and process sampling were defined in separate tables, or in a single table that identifies the end uses of the data.

16. Appendix H, Worksheet No. 18, page 8, Table 18.4: The sampling frequency for the GAC influent, midfluent, and effluent (rows 4, 5 and 6) is not consistent with that given in Section 5.6.2, page 5-7, third bullet.

17. Appendix H, Worksheet No. 18, page 9, Table 18.4: The ninth and tenth rows of this table states that the extraction manifolds and MPE wells will be sampled “At a minimum as needed at end of process to support transition decision making”. It is not clear what this means.


18. Appendix H, Worksheet No. 18, Table 18.4. Table 5-2, the third row under “Mass Removal”, that mass in extracted vapors will be measured at the vapor collection manifold in order to determine the amount of mass recovered in the vapor phase. This sampling does not appear to be captured in Appendix H, Worksheet No. 18, and Table 18.4. Due to the extreme variability in vapor concentrations during thermal remediation, it is recommended that samples of the combined vapor stream be analyzed via T0-15 at least on a weekly basis, with daily FID readings. This will aid significantly in monitoring the amount of

benzene recovered during different stages of the remediation, and will aid in determining when to transition from SEE to EBR.

19. Progress reports should include temperature distribution in the subsurface, the amount of contaminant mass recovered in each of the phases (LNAPL, aqueous phase, and vapor phase), water level and LNAPL levels from perimeter monitoring wells, and any additional samples that were collected to support the decision on when to transition from SEE to EBR.

If you have any questions regarding these comments, please call me at (415) 972-3150.

Sincerely,

A handwritten signature in black ink that reads "Carolyn d'Almeida". The signature is written in a cursive, flowing style.

Carolyn d'Almeida
Remedial Project Manager

cc: Wayne Miller, ADEQ